Figure 5 The effect of pass 4 packet loss for frame 4.

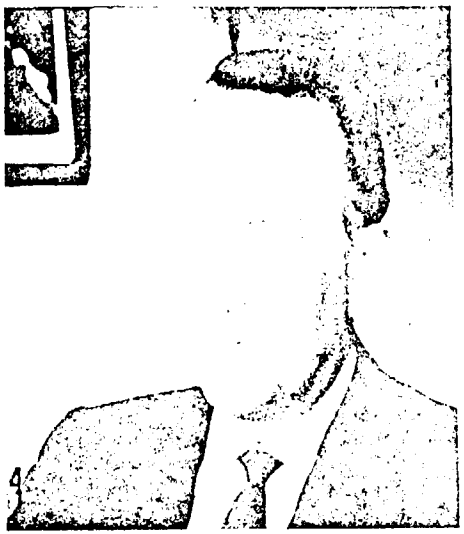

Figure 6 The effect of pass 1 packet loss for frame 3.

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A HYBRID LBG/LATTICE VECTOR QUANTIZER FOR HIGH QUALITY IMAGE CODING

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I. INTRODUCTION

It is well known that a vector quantizer (VQ) [1-4] is an efficient coder offering a good trade-off between quantization distortion and bit rate. The most popular vector quantizers are those constructed using the well known LBG algorithm [2]. The performance of a vector quantizer asymptotically approaches the optimum bound with increasing dimensionality. However in the case of LBG VQ, increasing the dimensionality causes the search and implementation complexity to be greatly increased and practical designs are therefore limited to low bit rates and small dimensionality. A vector quantized image suffers from the following types of degradations: a) Edge regions in the coded image contain staircase effects, b) Quasi-constant or slowly varying regions suffer from contouring effects, and, c) Textured regions lose details and suffer from granular noise. Staircase and contouring effects can immediately be spotted in an image; on the other hand, the effect of the granular noise is often mitigated by the very nature of the textured regions. All these three degradations are due to the finite size of the code book, the distortion measure used in the design and due to the finite training procedure involved in the construction of the code book. In this paper we present an adaptive technique which attempts to ameliorate the edge distortion and contouring effects.

In order to understand and evaluate the severity of the degradations caused by vector quantization, Ramamoorthy and Jayant performed several experiments by swapping regions in the coded image by the corresponding regions in the uncoded original[5]. When the coded edge regions were replaced with the corresponding regions of the uncoded original, the viewer failed to notice the granular and contouring distortions in the coded image. Careful examination over a long interval of time can indeed detect all the distortions present in the coded image. But a casual viewer who spent a few seconds of time in scrutinizing the coded image did not see the distortions. Given that edges are of such great importance, it makes sense that regions containing edges be quantized with higher fidelity. However, to do so generally requires a larger codebook, which is not feasible with an LBG VQ.

Appendix 2- Item 10